ADEQ
Arizona Department of Environmental Quality
Janet Napolitano, Governor
Stephen A. Owens, ADEQ Director

DEVELOPING AN EMS

This guidance manual represents the second environmental management system (EMS) module developed by the Pollution Prevention Unit, Technical Support Section of the Waste Programs Division, Arizona Department of Environmental Quality. It is one of the four EMS modules developed by the department. The manual is intended for use as a voluntary guidance document for small to medium size facilities wanting to establish an EMS. Questions and comments on the EMS modules can be directed to 602-771-4205 or js3@azdeq.gov.

Disclaimer

While this manual is written to provide assistance to individuals preparing an EMS as part of the Pollution Prevention Plan amendment, it does not replace the Arizona Revised Statutes, Title 49, Chapter 5, Articles 4 and 5. Those who prepare documents read the appropriate regulations before using this guidance.

PRINTED ON RECYCLED PAPER

July 26, 2005

Publication Number TM 07-05

EMS MODULE SERIES

Module One	-	Launching an EMS
Module Two	-	Developing an EMS
Module Three	-	EMS Implementation
Module Four	-	EMS Feedback

HOW TO USE THIS GUIDANCE

When you completed Module One of this template, your facility committed to implement an Environmental Management System (EMS). This commitment was shown by the appointment of an EMS Team and the signing of an Environmental Policy.

This Module Two explains the process necessary in setting up the EMS, a process which results in the identification of EMS projects. These projects are known as environmental objectives and targets.

Any process, if written in a formalized format, is called a procedure. The procedure used to set up an EMS can be found on page 6 of this module and is labeled the EMS Development Procedure. This procedure functions both as:

1. A framework on how you will set up the EMS.
2. A model procedure that you can replicate to set up your EMS.

In order to understand the content of the procedure, the five sections following the procedure are provided. Those sections are necessary in order to set up an EMS. The sections include:

(1) how to do facility assessment,
(2) how to identify aspects and impacts,
(3) how to identify applicable regulatory requirements,
(4) how to determine the significance of an impact, and
(5) how to develop objectives and targets.

Each of those sections is described by using examples, so that the result of setting up an EMS is visible for the readers. The end result of setting up an EMS is the development of environmental objectives and targets, shown on page 24.

From an outreach perspective, this module represents a thought process. Realizing that the EMS is a comprehensive concept and developing an EMS is not a simple task, readers with limited exposure to the EMS may find that this module is difficult to comprehend. Therefore, ADEQ is trying to fill this knowledge gap by providing a series of EMS workshops, and upon request, onsite EMS assistance to Arizona facilities. Facilities which are well advanced in their EMS development may find that this module is very basic.

Whether you are new to an EMS or well versed in the system, ADEQ would appreciate if you could provide your feedback on this document. Please send your questions or comments to js3@azdeq.gov or by phone to (602) 771-4205.

TABLE OF CONTENTS

Module Two – Developing an EMS

I. Introduction

This template facilitates you to develop a simple Environmental Management System (EMS). Normally, an EMS can be visualized as a Plan – Do – Check – Act model. Within this context, developing an EMS represents a **planning phase** of the model and covers the following four planning components: Environmental aspects and impacts, Legal and other requirements, Objectives and targets, and Environmental management programs.

(Note: The definitions of aspect, impact, objective, and target are provided in Appendix C)

An EMS helps you manage your activities, processes, products, or services that interact with or impact the environment. This means that in order to develop an EMS you have to do the following sequence of activities:

1. Identify activities, processes, products, or services of your facility
2. Determine aspects of these activities, processes, products, or services that can interact with or impact the environment
3. Document which aspects have environmental regulatory requirements
4. Evaluate which aspects have significant impacts using a rating criteria which you develop
5. Develop objectives and targets to manage those significant impacts

When you have identified legal requirements, determined your aspects and impacts, rated them as to significance, and developed objectives and targets, then you have completed the planning or development phase of your EMS.

This planning stage of the EMS is the backbone of the program. It helps you make decisions as to what to monitor and control in order to reduce your impact on the environment. Your objectives and targets should support your Environmental Policy and be updated periodically as goals are reached. At a minimum, you should review your EMS and set new goals annually.

As part of developing an EMS, you need to document a procedure that you will use to set up the EMS. Such a procedure is necessary for consistency, particularly when you do your EMS annual review in which you reconfirm significant aspects of your operation and review progress made against your objectives and targets.

II. EMS Development Procedure

The following is an example of a procedure that could be used to develop your environmental management system:

==========

Procedure No. **EMS-I**
Issue Date **January 1, 2005**
Rev. **0**
Title **Developing an EMS**
Approved by: **John Doe**

==========

1 Purpose

This procedure is developed to establish the planning elements of an EMS. It involves identification of the environmental aspects of this facility's activities, processes, wastes, products, and services that have significant environmental impact, and to develop objectives and targets for reducing those impacts.

2 Scope

2.1. This procedure will be used to identify activities, processes, wastes, products, and services of the organization and to establish a methodology for determining significant impacts.

2.2. A multifunctional team (i.e., a team consisting of representatives from many different parts of the organization) should participate in the identification of aspects and impacts. This team is the EMS team. By including representatives of the whole organization it increases the chances that all environmental impacts will be identified.

2.3. Criteria for evaluation of significant impacts can be regulatory requirements, estimated impact on the environment, legal liability, public risk, mitigation costs, frequency, severity, ability to control the impact, and others. The EMS team will need to choose a rating methodology using these or other criteria.

2.4. Based on the impacts determined to be significant using the rating methodology chosen, objectives and targets will be developed that promote pollution prevention, environmental compliance, and continuous improvement as stated in this facility's Environmental Policy.

2.5. Objectives and targets will be developed by assigned personnel responsible for the program, its measurement, and progress over time. The EMS manager oversees development and progress of objectives and targets over time.

3 Responsibilities

EMS manager- works with the EMS team and all employees to identify aspects, determine significant impacts, and develop objectives and targets.

EMS team- composed of representatives of all operational areas of the facility to identify and rank environmental aspects and impacts. Ensures on going development and refinement of the EMS.

Upper management- approves objectives and targets.

Environmental Program Managers- responsible for achieving objectives and targets and the means and timeframe for achieving them.

4 Definition

Environmental aspect: element of a facility's activities, processes, wastes, products, or services that can interact with the environment. An activity, process, waste, product, or service does not have to be regulated to be considered an aspect.

Environmental impact: any change to the environment due to a facility's activities, processes, wastes, products, or services. These changes can be positive or negative.

Environmental objective: an environmental goal, arising from the environmental policy, that a facility sets itself to achieve. An environmental objective is intended to reduce significant impacts, leading to improved environmental performance. Example of objective: to install a holding tank, piping, and pumping system in order to reuse treated water.

Environmental target: a detailed environmental goal, arising from the environmental objectives, applicable to the facility or parts thereof. An environmental target needs to be scheduled and assigned in order to meet an environmental objective. Example of target: to reduce water use by 30 percent over baseline in a 12-month period.

5 Procedure

5.1. Environmental aspects (inputs) will be identified by the EMS team and determined through the screening of activities, processes, wastes, products, and services that interact with the environment. The following aspects will be considered: use of chemicals, water, and energy; air emissions, wastewater discharges, and solid/hazardous waste generation.

5.2. Environmental impacts will be identified by the EMS team. Consider the word impact in terms of effect or output on the environment. The identified aspects and their environmental impact will be tabulated for significance (Table A). The following are impacts associated with aspects. Unless explicitly stated, these are negative impacts: depletion of resources (chemicals, water, energy), degradation of air quality, degradation of water quality including storm water pollution, disposal of solid/hazardous waste, contaminated groundwater or soil.

5.3 Once aspects are identified along with their associated impact(s), a methodology or criterion is used to quantify this relationship. The following criteria can be used to determine the significance of the impacts:

Use of natural resources (chemicals and other materials, water, energy)
Generation of hazardous waste
Generation of solid waste
Generation of wastewater
Emissions to air
Activity is regulated
Cost to mitigate
Employee and public concern
Frequency of occurrence
Severity of impact

Impacts with the highest scores will be considered the most significant impacts.

6 Updates and Reviews

The aspects, their rating criteria for significance, and objectives and targets will be reviewed and updated annually. Updates will also be required for any addition or modification of an activity, process, product or service. Changes to the criteria for determining aspects and significant impacts must be recorded in the facility's aspect procedure.

7 Records

Records generated from this procedure include flowcharts, list of aspects and impacts, aspect analysis, legal requirements, and objectives and targets.

III. Facility Assessment

To follow the preceding procedure, it may be helpful to first do a facility assessment. The first article of the above procedure requires the facility to identify and rate those aspects of the facility's activities, processes, wastes, products, or services that interact with the environment. The identification and rating of the aspect will be conducted by the whole EMS team.

A good first step in identifying aspects and impacts is knowing about the facility itself. This includes collecting facility information and analyzing the facility's manufacturing processes.

A. Gathering Facility Information

Facility information which is important for analysis includes:

. What processes are currently active? What are inactive?
. Where are incoming materials and products stored?
. What type of wastes are generated and how are they managed?
. What operations, process diagrams, engineering drawings does your facility have?

The above and other relevant information can be obtained from the facility's file, from talking with employees and by walking around the facility Some of the aspects that will be identified will include:

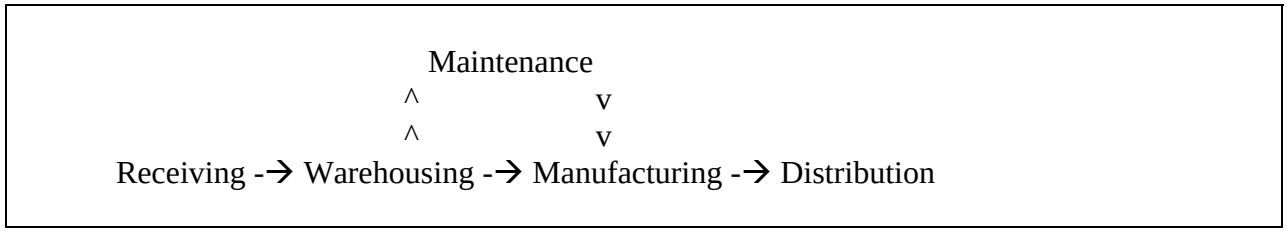
. Raw materials, water use, and energy consumption.
. Solid and hazardous wastes generation.
. Wastewater discharges.
. Air emissions.
. Facility site surrounding land use, and potential for spills and contamination.

(Note: See Appendix A for a list of possible Environmental Aspects that may occur at your facility)

B. Analyzing the Facility's Activities

To facilitate the analysis of the facility's business, it is helpful to flowchart the facility processes so that it can be evaluated at different levels of detail. At a higher level of analysis, i.e., the macro level, a simple flowchart for the whole facility, which starts from the introduction of raw materials at the point of entry to the shipment of finished products, may look like Figure 1.

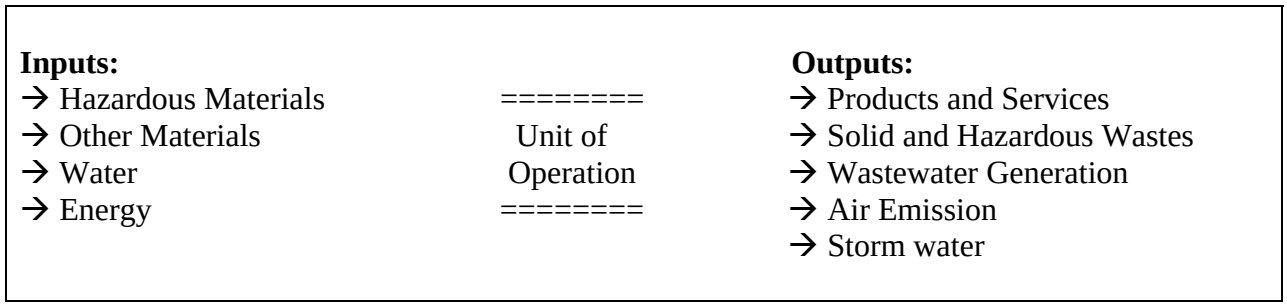
Figure 1 – Facility Process



The above flowchart shows that the facility process consists of five sub-processes, i.e., receiving, warehousing, maintenance, manufacturing, and distribution. They are called units of operation.

Once the units of operation are determined, the EMS team will create a flowchart for each of the units. This is a visual aid for picturing work processes which show how inputs, actions, and outputs are linked. A typical flowchart connecting the inputs (hazardous materials, other materials, water, and energy), the actions (facility processes) and the outputs (products and services, solid and hazardous wastes, wastewater generation, air emission, and storm water) is displayed in Figure 2.

Figure 2 – Typical Operational Unit Flowchart



The following diagram (Figure 3) is an example of a flowchart for a Warehousing Operational Unit. It consists of inputs in the form of incoming deliveries via trucks from the Receiving Operational Unit and the consumption of resources, such as air (HVAC and heat), water, electricity, and propane (to power forklift). The outputs are outgoing deliveries to the Manufacturing Operational Unit and environmental pollutants. Environmental pollutants include solid and hazardous wastes (from packaging and forklift used oil respectively), wastewater discharges, air emissions, and potential chemical spills and releases. Outputs from activities are synonymous with aspects **if they interact with the environment**.

Figure 3 – Warehousing Operational Unit Flowchart

Inputs:		**Outputs**
→ Deliveries from Receiving	=========	→ Deliveries to Manufacturing
→ HVAC & heat Water Electricity Propane	Warehouse Operational Unit =========	→ Sanitary waste Storm water Air emissions Solid and hazardous wastes

If you have current process diagrams, review them. If no diagrams are available, you can create your own. Here are some helpful tips in developing a flowchart:

. Identify equipment such as electrical transformers and monitoring equipment which may contain PCB, radioactive, or other regulated materials.

. Identify auxiliary service equipment such as air compressors, boilers, cooling towers, HVAC, refrigerators, air handling systems, and heat exchangers. They both consume resources and may generate pollutants. Possible pollutants can be containers and packaging, waste streams from production, maintenance activities, or remedial projects.

. Identify storage tanks (above ground or underground), piping systems (for fuels and chemicals), drainage systems and storm water discharge conduits, wastewater treatment systems, water sprays, sumps, hoods, vents, stacks, paint booths, dumpster, and waste storage areas.

If your facility generates any wastes that are not on the flowcharts, describe them in a space provided below the flowchart.

The use of a cross functional team to evaluate a facility's operation is essential to ensure no activity or output is overlooked.

C. Analyzing the Facility's Surroundings

The purpose of analyzing your facility and surrounding area is to evaluate conditions that may warrant public concern from interested parties (environmentally sensitive areas or areas of high population density). Record those conditions in your facility map.

In order to obtain the necessary information, you need to tour your facility, observe the physical setting, and make notes as necessary. These are some of the data that are important to be mapped:

About the facility

. Physical conditions and the age of the buildings
. Unidentified pipes and stacks
. Chemical storage area
. Past chemical and waste handling and storage areas
. Waste storage area

About the surrounding area

. Land use of the area immediately bordering your facility. This can be residential, commercial, industrial, or agricultural areas.
. Distance between your facility and the closest residential area.
. Location of nearby recreational facilities or conservation areas.
. Location of nearby ditches, streams, rivers, or lakes.
. Storm water runoff patterns.

IV. Identification of Aspects and Impacts

The facility assessment process described in the preceding section provides sufficient information for the facility to continue with the identification of aspects and impacts. This means, to know how the facility interacts with and impacts the environment, either positively or negatively.

The identification process is relatively simple. First, look at the inputs and outputs of each of the flow charts and find out whether there is an output that interacts (or potential to interact) with the environment. Then, of the outputs (or aspects) that you have identified, what is the impact on the environment. Finally, for each activity, process, product, and service, list its aspects and impacts in a tabular form. Please note that for each activity, process, product, and service, it may have more than one aspect and impact. A sample aspect/impact table is provided below in Table A:

Table A

Activity, Process, Product, Service	Aspect	Impact
Warehousing	Electricity use Ventilation emission Wastewater discharge	Deplete energy resources Degrade air quality (CO2 or freon) Discharge of wastewater to POTW Deplete resources (water)
	Chemical spill potential (due to unloading and transfer operations)	Storm water contamination Deplete resources
	Generation of solid waste (due to packaging)	Disposal of solid waste Deplete resources
Maintenance	Use of paints and solvents	Deplete raw material Disposal of used paints and solvents
	Use of oils	Deplete raw material Disposal of used oil
	Oil spill potential	Soil, groundwater, and storm water contamination
	UST leak potential	Soil, groundwater, and storm water contamination
	Vehicle refueling emission Refueling spill potential	Degrade air quality Storm water contamination

Boiler	Use of fuel oil from AST Fuel oil spill (potential) Air emission Use of chemicals for treating water, boiler blow down Chemical spill (potential) Wastewater generation (due to normal operation)	Deplete raw material Soil, groundwater, and storm water contamination Degrade air quality Deplete raw material Storm water pollution from blow down Contamination of water discharges Wastewater discharge (to city POTW)

V. Analyzing Environmental Regulatory Requirements

Your environmental policy strives for pollution prevention, environmental compliance, and continuous improvement. To adhere to compliance with environmental laws and regulations, it is necessary to know what the legal and business requirements of the EMS are for your facility. Although this EMS focuses on environmental compliance, if you wish, you can add those provisions required by the Occupational Safety and Health Administration (OSHA).

The environmental requirements include:

. Federal requirements
. State requirements
. Municipal requirements
. Environmental permitting
. Compliance monitoring
. Record keeping and reporting
. Contingency plans

The OSHA requirements may include:

. Process Safety Management
. Association initiatives, such as Responsible Care of CMA, EMAS
. Industrial practices

(Note: See Appendix B for a list of possible Environmental Requirements that may apply to your facility)

The following activities will help the environmental regulatory assessment process.

1. Identify individuals responsible for environmental compliance at the facility. Specify areas of responsibility for each person.
2. Identify contractors who provide environmental services to the facility. Indicate the type of service they offer. Their activities may be regulated.
3. Identify regulatory agencies that the facility would contact for information. Include the names of the contact person, phone number, and email address.
4. Identify all environmental permits possessed by the facility. Provide essential information for each of the permits, such as permit type, permit number, issuing authority, issue date, and expiration date.
5. Identify any legal orders against the facility. Describe the type of the order (e.g. consent order, consent judgment, notice of violation, notice of opportunity to correct), issuing authority, issue date, and required action by the facility.
6. Identify reports, plans, and other documents the facility is required to submit or maintain. These may include emergency spill plans, discharge monitoring records, site remediation plans, pollution prevention plans, pollution prevention progress reports, toxic release inventory forms, hazardous waste manifests, hazardous waste annual reports, etc. Specify the type of the reports, agency requiring it, and frequency of reporting.
7. Identify specific programs and procedures under which the facility operates. The list may include the facility's standard operating practices, pollution prevention, recycling, process safety management, responsible care, EMS, or ISO-9000 programs. Include the names of the program, initiation date, and person responsible for the program.

Once you obtain the above information, tabulate the information in a simple column and row format for easy use. It can be very helpful to list all environmental aspects and, if they are regulated, by what regulation. Appendix B can help with this exercise.

VI. Determination of Significance

As illustrated in the previous table, some aspects of your facility operation may result in certain impacts to the environment. These impacts can be positive or negative. The role of an EMS is to address and control any adverse environmental impacts created by your facility operation. These are known as the significant impacts. An aspect which causes a significant impact is termed a significant aspect.

The determination of significant impact will be conducted by the EMS team. To know the significance of an impact requires that each of those listed impacts must be examined using certain criteria. The criteria posted in the procedure II, 5.3, on page 8 are typical for use in significant impact determination.

Once an impact is evaluated by appropriate criteria, a total score for that impact can be obtained (Table B).

In the sample warehouse operation, for example, due to the unloading and transfer operations, there is a potential for chemical spills which can result in storm water contamination, an adverse environmental impact. This facility has chosen the following criteria:

. Loss of chemicals (depletion of resources)
. Generation of waste (amount of waste generated)
. Activity is regulated (permit or operational requirements)
. Land contamination (potential cost to mitigate)
. Employee and public concern (interested parties)
. Frequency of occurrence

The EMS team then assigns a rating to each of the above criteria by using a rating system based on the following guidelines:

. Depletion of resources	> 55 gallons	score = 3
	10 – 54 gallons	score = 2
	5 – 9 gallons	score = 1
	< 5 gallons	score = 0
. Amount of waste generated	> 55 gallons,	score = 3
	10 – 54 gallons,	score = 2
	5 – 9 gallons,	score = 1
	< 5 gallons,	score = 0
. Regulated	If yes,	score = 3
	If no,	score = 0
. Cost to mitigate	> $100,000	score = 3
	$10,000 – 100,000	score = 2
	$1,000 – 10,000	score = 1
	< $1,000	score = 0
. Interested parties	If yes,	score = 3
	If no,	score = 0
. Frequency of occurrence	> 6 times/year,	score = 3
	3-5 times/year,	score = 2
	1-2 times/year.	score = 1
	None	score = 0

The following is the score of impact resulting from potential chemical spills during unloading or transfer operations.

. Loss of chemicals	score = 1
. Amount of waste generated = 50 gallons,	score = 2
. Permit for site cleanup is required,	score = 3
. Cost to cleanup site contamination = $ 50,000	score = 2
. Interested parties = none	score = 0
. Frequency of occurrence = once/year	score = 1
Total Impact	score = 9

The total score that reflects the significance of this environmental impact is 9 (See aspect #4, Table B). A similar exercise applies to other impacts. The result of the exercise is then tabulated. The following table illustrates the tabulation results for warehousing, maintenance, and boiler activities.

Table B

Activity, Process, Product, Service	Aspect	Depletion of resources	Amount of waste generated	Regulated	Cost to mitigate	Interested parties	Frequency of occurrence	Total Score of Impact
Warehousing	1. Electricity use	3	0	3	0	3	3	12
	2. Ventilation emissions	0	2	3	1	3	3	12
	3. Wastewater discharge	3	3	0	0	0	0	6
	4. Chemical spill potential	1	2	3	2	0	1	9
	5. Generation of solid waste	2	3	3	0	3	3	14
Maintenance	6. Use of paints and solvents	3	1	3	0	3	3	13
	7. Use of oils	2	1	0	0	0	3	6
	8. Oil spill potential	1	2	3	2	0	1	9
	9. Underground storage tanks (UST) leak potential	3	3	3	3	3	1	16
	10. Vehicle refueling emission	0	0	0	0	3	3	6
	11. Refueling spill potential	1	2	3	1	0	2	9

Activity, Process, Product, Services	Aspect	Depletion of Resources	Amount of waste generated	Regulated	Cost to mitigate	Interested parties	Frequency of occurrence	Total Score of Impact
Boiler	12. Use of fuel from above ground storage tanks (AST)	3	1	3	0	3	3	13
	13. Fuel oil spill potential	1	2	3	1	0	1	8
	14. Air emission	0	2	3	1	3	3	12
	15. Boiler blowdown	3	3	3	0	3	3	15
	16. Chemical spill potential	1	2	3	3	0	1	10
	17. Wastewater generation due to normal operation	3	2	3	0	3	3	14

After all impacts are scored, the EMS team decides what the cutoff point for significance is. The above table shows that the total score for each aspect ranges from 6 to 16. The cutoff point that the facility decides, for example, can be any number greater than 11. If that is the case, then out of the 17 aspects, the following nine aspects are considered having significant impacts.

<u>Warehousing Operation:</u>

1. Electricity use, score = 12
2. Ventilation emission, score = 12
3. Generation of solid waste, score = 14

<u>Maintenance:</u>

4. Use of paints and solvents, score = 13
5. UST leak potential, score = 16

<u>Boiler:</u>

6. Use of fuel from AST, score = 13
7. Air emission, score = 12
8. Use of chemicals for treating water, boiler blow down score = 15
9. Wastewater generation due to normal operation, score = 14

VII. Development of Objectives and Targets

Objectives and targets are developed to address those aspects which a facility has determined to have significant impacts. They should support the Environmental Policy which promotes pollution prevention, environmental compliance, and continual improvement. Objectives and targets must be based on technological options, economic feasibility, views of interested parties, and legal considerations. The development of objectives and targets should be conducted by EMS team members who are related to the affected activities.

An objective is a goal that the facility sets to achieve in order to minimize significant impacts. (Appendix C)An example would be: *to install a holding tank, piping, and pumping system in order to reuse treated wastewater*.

A target is a detailed goal, with quantitative measurement and a time frame to achieve this detailed goal. An example would be: *to reduce water use by 30 percent over baseline in a 12-month period*. Included in the decision of targeting is the assignment of staff responsible for achieving each of the targets. Please note that the actual achievement of a target requires commitment and coordination from multifunctional departments, but one responsible person is needed to direct the effort.

To illustrate the process of developing objectives and targets, let us look at the boiler operation previously described. A boiler is a closed vessel where water is heated via combustion to a predetermined temperature, providing either steam or hot water. The fuel input into the boiler results in the generation of steam.

In our example, the EMS team has decided to consider the following four aspects for the boiler which are considered to have significant impacts:

1. Use of fuel
2. Air emissions
3. Use of chemicals for treating water
4. Wastewater generation due to normal operation

1. Use of fuel

Boiler fuel often contain impurities which impair boiler operation and efficiency. Fuels vary in BTU content, costs, and the generation of waste. Fuels containing impurities form gas and solid combustion-by-products. Incomplete combustion of the fuel and corrosion of the inside part of the boiler also produce solid wastes. Selection of fuel is dictated by availability and the overall cost per pound of steam which includes cost of fuel, storage, preparation, handling and the total contribution of pollutants to the air around the facility.

A possible option for the facility is to use chemical additives or use cleaner fuels to reduce fouling. Natural gas is less likely to cause fouling, but availability or cost may limit its use. Because the EMS team does not find a substitute for its current fuel, the team will not suggest any objective or target, except continue to search for fuel substitution.

2. Air Emissions.

The type of fuel the facility uses affect the air emissions from a boiler. If substitution of a cleaner fuel is not an option, options for emission reduction must be looked at. Since pulverized coal fuels are being burned in the facility, NOx and CO can be reduced with the change of a standard burner currently used by the facility with a low emission type burner. Further reduction can be obtained with the addition of a flue gas recirculation system, or a steam injection system. In this case, the EMS team decides to implement both options, i.e. to *replace the burner* and to *install a flue gas recirculation system*. These are two objectives related to the air emission aspect. The respective targets are *the reduction of NOx and CO by 10%*, and *the reduction of NOx and CO by 5%*. Both targets are over baseline in a 12-month period.

3. Use of chemicals for treating water.

Boiler feedwater often contains impurities which impairs boiler operation and efficiency. Removal of deposits and corrosion products from the *waterside of boiler tubes* results in the generation of "boiler chemical cleaning wastes". The composition of cleaning wastes depends on boiler feedwater composition, boiler tube metallurgy, time between chemical-cleaning tasks, task time, and type of cleaners used.

The EMS team decides that in order to improve boiler feed water, *reverse osmosis equipment will be installed ahead of ion exchanges* to reduce mineral loading and frequency of regeneration. This is the objective. The target is to *reduce mineral loading by 20%*.

For boiler cleaning, sodium polyacrylate injection may be used to remove deposits without having to shut down the boiler. For this option, the team is still indecisive until further evaluation is completed.

4. Wastewater generation due to normal operation.

Think of reuse every time wastewater is generated. Although some pretreatment and chemical segregation are required, the EMS team decides to *reuse it for cooling-tower makeup* as the objective. The pay back comes in the form of *conserving water by as much as 25%*. That is the target: 25% over baseline in a 1-year period.

The process of developing objectives and targets for warehousing operation and maintenance is similar to that process used for the boiler. Although the process for warehousing and maintenance is not described in this template, the outcome is outlined in the following Table C. The table displays objectives and targets developed to address all those nine significant aspects in the warehousing operation, maintenance, and boiler identified in our aspect analysis. The result in our exercise is seven identified objectives and targets. Three staff are responsible for the implementation and completion of the objectives and targets. Targets imply reductions over baseline amounts which must be established prior to launching the objective.

Table C

No	Aspect with significant impact	Objective	Target	Completion Schedule	Responsible Staff
1	Electricity use	Replace lighting bulbs with high efficiency bulbs	Reduce energy use by 10%	March 2005	James A.
2	Ventilation emissions	No action	-	-	-
3	Generation of solid Waste	Implement in-house recycling	Recycle 90% of solid waste generated	March 2005	James A.
4	Use of paints and solvent	Substitute paints and solvents with water based materials	Reduce VOC emission by 20%	March 2005	Cathy B.
5	UST leak potential	No action	-	-	-
6	Use of fuel	No action	-	-	-
7	Air emissions	Replace the standard burner with a low emission type burner Install flue gas recirculation system	Reduce NOx and CO by 10% Reduce NOx and CO by 5%	December 2005 March 2006	Robert C. Robert C.
8	Use of chemicals for treating water	Install reverse osmosis equipment ahead of ion exchanges	Reduce mineral loading by 20%	September 2005	Robert C.
9	Wastewater generation due to normal operation	Build a pretreatment unit and reuse pretreated wastewater for cooling-tower	Reduce water use by 25%	June 2006	Robert C.

The above table reveals two important facts in developing objectives and targets:

- Not every aspect with significant impact is required under ISO-14000 to have an objective and target. Developing an objective may necessitate the facility to buy and install new equipment. Since the current budget does not allow for this, the facility will elect to do nothing until the next fiscal year. Or, the new technology may require further research for applicability, i.e., in relation to product quality issue or return of investment.

- An aspect may result in more than one objective. It can result in two, three, or even five objectives related to an aspect.

Objectives and targets will be developed to address significant impacts. They must promote pollution prevention, environmental compliance, and continuous improvement. Objectives and targets will be developed by the EMS manager with the assistance of the EMS staff. Objectives and targets should be directly related to the activity, process, waste, products, or service that has a significant impact. Objectives and targets must be approved by upper management

The aspects, their rating criteria for significance, and objectives and targets will be reviewed and updated annually. Updates will also be required for any addition or modification of an activity, process, product or service. Changes to the criteria for determining aspects and significant impacts must be recorded in the facility's aspect procedure.

VIII. Summary

The process of developing an EMS is illustrated in this module. The procedure shows that in order to develop an EMS, it requires that a facility identify its aspects of those activities, processes, products, or services that impact the environment.

After aspects are identified, then the facility needs to determine which of those aspects have significant impacts. The determination of significance is conducted by using a rating criteria developed by the facility. The result of this process is a list of aspects that have significant impacts. From the list, objectives and targets are developed with the goal of reducing the impacts, within a specified time frame, and with an assigned EMS staff coordinating the implementation.

The assessment of the facility, the identification of aspects and impacts, and legal requirements, the determination of significance, and the development of objectives and targets are the components of EMS planning activities. This module, following the sequences of the planning protocol, presents an example of things to do in developing the backbone of an EMS. The example is given to show the thought process, or as a guidance for any facility intending to develop an EMS of its own.

The result of the exercise is tabulated below. The table reflects the scope of a typical EMS plan and highlights the relationship between a facility's activities, processes, products, or services with its related aspects, a variety of impacts, the cumulative impacts as indicated by the total score of impact, and the objectives and targets which are planned to be accomplished by the facility.

Activity, process, product, service	*Aspect*	*Deplet. of resour.*	*Amount of waste generat.*	*Regula.*	*Cost to mitigate*	*Interes. parties*	*Freq. of occur.*	*Total score of impact*	*Objective*	*Target*	*Cmpl sched.*	*Resp. staff*	*Goal #*
Ware Housing	Electricity use	3	0	3	0	3	3	12	Replace lighting bulbs with high efficiency bulbs	Reduce energy use by 10%	3/05	Jim	1
	Ventilation emission	0	2	3	1	3	3	12					
	Wastewater discharge	3	3	0	0	0	0	6					
	Chem. spill potential due to unloading and transfer operations	1	2	3	2	0	1	9					
	Generation of solid Waste	2	3	3	0	3	3	14	Implement inhouse Recycling	Recycle 90% of solid waste generated	3/05	Jim	2
Mainte nance	Use of paints and solvents	3	1	3	0	3	3	13	Substitute paints and Solvents with water based Materials	Reduce VOC emission by 20%	3/05	C.B.	3
	Use of oils	2	1	0	0	0	3	6					
	Oil spill potential	1	2	3	2	0	1	9					
	UST leak potential	3	3	3	3	3	1	16					
	Vehicle refueling emission	0	0	0	0	3	3	6					
	Refueling spill potential	1	2	3	1	0	2	9					

Activity, process, product, service	*Aspect*	*Deplet. of resour.*	*Amount of waste generat.*	*Regula.*	*Cost to mitigate*	*Interes. parties*	*Freq. of occur.*	*Total score of impact*	*Objective*	*Target*	*Cmple sched.*	*Resp. staff*	*Goal #*
Boiler	Use of fuel	3	1	3	0	3	3	13					
	Fuel oil spill potential	1	2	3	1	0	1	8					
	Air emissions	0	2	3	1	3	3	12	Replace the standard burner with a low emission burner	Reduce NOx and CO by 10%	12/05	Bob	4
									Install flue gas recirculation system	Reduce NOx and CO by 5%	3/06	Bob	5
	Use of chemicals for treating water, boiler blow down	3	3	3	0	3	3	15	Install reverse osmosis ahead of ion exchanges	Reduce mineral loading by 20%	9/05	Bob	6
	Chemical spill potential	1	2	3	3	0	1	10					
	Wastewater generation due to normal operation	3	2	3	0	3	3	14	Install a pretreatment unit and reuse pretreated wastewater for cooling-tower	Reduce water use by 25%	6/06	Bob	7

APPENDICES

Appendix A – Example of Environmental Aspects

Activity, Process, Product, Service	Aspect
Heat treat furnace	Air emissions Solid carbon Ammonia
Machining aluminum	Filter media with lead waste Aluminum Aluminum parts
Machining bronze	Lead waste Bronze
Machining steel	Deburr air emissions Spent deburr brushes Spent polishing tape Steel Steel parts
Welding	Flux Weld spatter Wire feed
Cutter grind	Electrolyte salts Emissions to permitted dust collector Seal peal
Maintenance	Natural gas Compressor oil Ethylene glycol Fertilizer Paints and solvents Cans Paint related materials Paint booth emissions Adhesive PVC glue Water/air filters
Press room	Corn cob Corn cob waste Dust from sanding Walnut shell Walnut shell waste Air emissions (particulates)

Activity, Process, Product, Service	Aspect
Power house	Standby fuel oil Boiler emissions Coal Residual coal Particulate, ash Pipe insulation waste Reagents Salt
Storm water treatment	Screenings Effluent
Wastewater treatment	Air scrubber emissions Anionic polymer Cationic polymer Desiccant cartridges Waste desiccant cartridges Grit screenings Phosphoric acid Process sludge Tank cleaning sludge Sodium hydroxide Skimmings Sulfuric acid Wastewater effluent
Shipping and receiving	Spent air filters Cardboard waste Used gloves Plastic waste Used rags Styrofoam waste Steel shot waste Tumbler media waste Stubs of welding rods Trash Wood pallets
Cafeterias	Utensils and cooking supplies Waste grease Food products Food waste Packaging/plactic waste
Fire protection	Baking soda Spill control agent Used spill control agent Waste personal protection equipment (PPE)

Activity, Process, Product, Service	Aspect
Janitorial	Sanitary waste to sewer Hand soap and lotion Floor soap Cleaning chemicals
Laboratory	Glycerin Glass waste Hexane Lab packs Lay out die Liquid nitrogen Metal polish Mineral spirits
Medical	Infectious waste Medical supplies
Office	Paper Energy/electricity Waste paper Copy developer Copy fuser lubricant Copy toner Used copy toner Toner cartridges
Oil storage yard	Oil containers Bottled gas Degreaser Plastic containers
Manufacturing	Chemicals Waste chemicals Air emissions Wipers Energy/electricity Fuel
Surface preparation	Spent blasting media Air emissions (particulates) Acids and solutions Spent acids and solutions Wastewater

Appendix B – Example of Environmental Requirements

Aspect	Requirements	Citation
Material storage and use	CERCLA's Hazardous Substances and Reportable Quantities	40 CFR Part 302
	SARA Title III's Hazardous Waste Reporting – Community Right to Know	40 CFR Part 370
	SARA Title III's Toxic Chemical Release Reporting – Community Right to Know	40 CFR Part 372
	Underground Storage Tank (UST) Management	ARS §49-1001 – ARS §49-1094
Air emissions	Federal Air Quality	40 CFR Parts 50-99
	CFC Containing Equipment	40 CFR Part 82
	State Air Quality Permit	ARS §49-421 - ARS §49-467
Water discharges	Discharge of Oil	40 CFR Part 110
	Spill Pollution Control and Countermeasures (SPCC)	40 CFR Part 112
	State Wastewater and Storm Water Discharge Permit	ARS §49-255
	Test Procedures for Analysis of Pollutants	40 CFR Part 136
	State Aquifer Protection Permit	ARS §49-241 – ARS §49-252
	City Water & Sewerage Permit	City Ordinance

Solid & hazardous waste	Hazardous Waste	40 CFR Parts 264-265 40 CFR Part 268
	Used Oil Management Standards	40 CFR Part 279
	Toxic Substance Control Act	40 CFR Part 700
	PCB Waste Management	40 CFR Part 761
	Asbestos Management	40 CFR Part 763
	Solid Waste Management	ARS §49-701 – ARS §49-881
	Medical Waste	AAC: R18-13-1401 – R18-13-1420

Appendix C – EMS Form 4: EMS Development Procedure

Procedure No. :
Issue Date :
Rev. :
Title : Developing an EMS
Approved by :

1 Purpose

This procedure is developed to establish the planning elements of an EMS. It involves identification of the environmental aspects of the **XYZ Company's** activities, processes, wastes, products, and services that have significant environmental impact, and to develop objectives and targets for reducing those impacts.

2 Scope

2.1. This procedure will be used to identify activities, processes, wastes, products, and services of the organization and to establish a methodology for determining significant impacts.

2.2. A multifunctional team (i.e., a team consisting of representatives from many different parts of the organization) should participate in the identification of aspects and impacts. This team is the EMS team. By including representatives of the whole organization it increases the chances that all environmental impacts will be identified.

2.3. Criteria for evaluation of significant impacts can be regulatory requirements, estimated impact on the environment, legal liability, public risk, mitigation costs, frequency, severity, ability to control the impact, and others. The EMS team will need to choose a rating methodology using these or other criteria.

2.4. Based on the impacts determined to be significant using the rating methodology chosen, objectives and targets will be developed that promote pollution prevention, environmental compliance, and continuous improvement as stated in the **XYZ Company's** Environmental Policy.

Objectives and targets will be developed by assigned personnel responsible for the program, its measurement, and progress over time. The EMS manager oversees development and progress of objectives and targets over time.

3 Responsibilities

EMS manager – works with the EMS team and all employees to identify aspects, determine significant impacts, and develop objectives and targets.

EMS team – composed of representatives of all operational areas of the facility to identify and rank environmental aspects and impacts. Ensures on going development and refinement of the EMS.

Upper management – approves objectives and targets.

Environmental Program Managers – responsible for achieving objectives and targets and the means and timeframe for achieving them.

4 Definition

Environmental aspect: element of a facility's activities, processes, wastes, products, or services that can interact with the environment. An activity, process, waste, product, or service does not have to be regulated to be considered an aspect.

Environmental impact: any change to the environment due to a facility's activities, processes, wastes, products, or services. These changes can be positive or negative.

Environmental objective: an environmental goal, arising from the environmental policy, that a facility sets itself to achieve. An environmental objective is intended to reduce significant impacts, leading to improved environmental performance. Example of objective: to install a holding tank, piping, and pumping system in order to reuse treated water.

Environmental target: a detailed environmental goal, arising from the environmental objectives, applicable to the facility or parts thereof. An environmental target needs to be scheduled and assigned in order to meet an environmental objective. Example of target: to reduce water use by 30 percent over baseline in a 12-month period.

5 Procedure

5.1. Environmental aspects (input) will be identified by the EMS team and determined through the screening of activities, processes, wastes, products, and services that interact with the environment. The following aspects will be considered: use of chemicals, water and energy, air emissions, wastewater discharges, and solid/hazardous waste generation.

5.2. Environmental impacts will be identified by the EMS team. Consider the word impact in terms of effect or output on the environment. The identified aspects and their environmental impact will be tabulated for significance. The following are impacts associated with aspects. Unless explicitly stated, these are negative impacts: depletion of resources (chemicals, water, energy), degradation of air quality, degradation of water quality including storm water pollution, disposal of solid/hazardous waste, contaminated groundwater or soil.

5.3. Once aspects are identified along with their associated impact(s), a methodology or criterion is used to quantify this relationship. The following criteria can be used to determine the significance of the impacts:

Use of natural resources (chemicals and other materials, water, energy)
Generation of hazardous waste
Generation of solid waste
Generation of wastewater
Emissions to air
Activity is regulated
Cost to mitigate
Employee and public concern
Frequency of occurrence
Severity of impact

Impacts with the highest scores will be considered the most significant impacts.

6 Updates and Reviews

The aspects, their rating criteria for significance, and objectives and targets will be reviewed and updated annually. Updates will also be required for any addition or modification of an activity, process, product or service. Changes to the criteria for determining aspects and significant impacts must be recorded in the facility's aspect procedure.

7 Records

Records generated from this procedure include flowcharts, list of aspects and impacts, aspect analysis, legal requirements, and objectives and targets.

Appendix D - EMS Form 5: Input/Output for Units of Operation

Facility:
Date:

Unit of Operation	Input	Output = Aspect (if interact with the environment)	Output (no interaction with the environment)
Warehouse	Deliveries from Receiving HVAC & heat Water Electricity Propane	Wastewater Ventilation emissions Solid waste Electricity use Chemical spill potential	Deliveries to Manufacturing

Appendix E – EMS Form 6: Aspect and Impact Analysis

Facility:
Date:

Activity, Process, Product, Service	Aspect	Impact
Warehousing	Wastewater	Discharge to POTW Deplete resources/water
	Ventilation emission	Degrade air quality
	Solid waste	Disposal of solid waste
	Electricity use	Deplete resources/energy
	Chemical spill potential	Storm water contamination Deplete resources/chemical

Appendix F – EMS Form 7: Aspect and Impact Analysis for Significance

Facility:
Date:

Activity, Process, Product, Service	Aspect	Depletion of Resources	Waste Generated	Regulated	Cost to Mitigate	Interested Parties	Frequency of occurrence	Total Impact

Appendix G – EMS Form 8: Objectives and Targets for Aspects Considered to have Significant Impacts

Facility:
Date:

No	Aspect with significant impact	Objective	Target	Completion Schedule	Responsible Staff
1					
2					
3					
4					
5					
6					
7					
8					
9					
10					
11					
12					

Appendix G – Glossary

Environmental Management System (EMS): a formal set of procedures and policies that define how an organization will manage and reduce its impacts on the environment.

Developing an EMS: (1) the planning phase of the Plan-Do-Check-Act model, (2) a process which follows the steps outline in the EMS Development procedure, (3) a process which result in the formulation of environmental objectives and targets.

EMS Development procedure: the framework and blueprint on how to set up an EMS. This procedure describe actions including (1) conducting facility assessment, (2) identifying aspects and impacts, (3) determining the significance of an impact, and (4) developing objectives and targets.

Environmental aspect: element of a facility's activities, processes, wastes, products, or services that can or does interact with the environment. An activity, process, waste, product, or service does not have to be regulated to be considered an aspect.

Environmental impact: any change to the environment, whether adverse or beneficial, due to a facility's activities, processes, wastes, products, or services.

Environmental objective: an environmental goal, arising from the environmental policy, that a facility sets itself to achieve. An environmental objective is intended to reduce significant impacts, leading to improved environmental performance. Example of objective: to install a holding tank, piping, and pumping system in order to reuse treated water.

Environmental target: a detailed environmental goal, arising from the environmental objectives, applicable to the facility or parts thereof. An environmental target needs to be scheduled and assigned in order to meet an environmental objective. Example of target: to reduce water use by 30 percent over baseline in a 12-month period.

Plan-Do-Check-Act model: a cycle of activities that describes the content of an EMS.

Pollution Prevention (P2): operational procedures, processes and improvements in housekeeping or management technique that reduce the potential or actual releases of pollutants to the overall environment including air, water, and land. P2 techniques include toxic use reduction; reduction at the source of a process by changing raw material, technology, product specification, and good operating procedure; and recycling of wastes through reuse or reclaim/recover valuable components from the waste.